Standing in late pregnancy - unexpected effects of maternal and fetal circulation

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We have been studying for some time the influence of posture during gestation on the maternal circulation and have made the following observations:

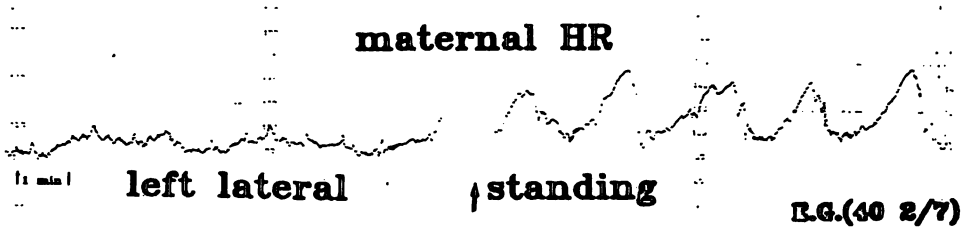

Fig.1: Typical recording of maternal beat to beat heart rate in left lateral and standing posture of a woman in late pregnancy (40 2/7 wks).

After changing from the lying to standing position, 33 of 51 (65 %) investigated healthy women in late pregnancy showed cyclic heart rate accelerations (Fig.1) with a mean amplitude of 27 (range 9-51) beats per minute. The mean cycle length was 105 seconds and persisted throughout the investigated periods lasting from 10-30 minutes. During the phase of increasing heart rate, the cardiac output (measured by the indirect Fick principle) and blood pressure fell. Despite considerable phasic tachycardia in in some women, they did not experience subjective symptoms. The disturbance in the maternal circulation was accompanied by a change in the fetal heart rate patterns in 70 % of the cases investigated. Because in some recordings the oscillations of the maternal heart rate were reduced when the woman was leaning forward or when her uterus was lifted upwards, we came to believe that in the upright posture the uterus might compress the major pelvic vessel - as in the vena casa syndrome in a supine position - leading to an impaired venous return, and to the observed compensatory circulatory adjustments. This hypothesis was supported by the observation that immediately post partum the phenomenon was no longer reproducible. Further studies using continuous ultrasound Doppler over the femoral vein in the groin showed that the venous flow velocity decreased considerably concomitant with phases of tachycardia (Fig. 2).

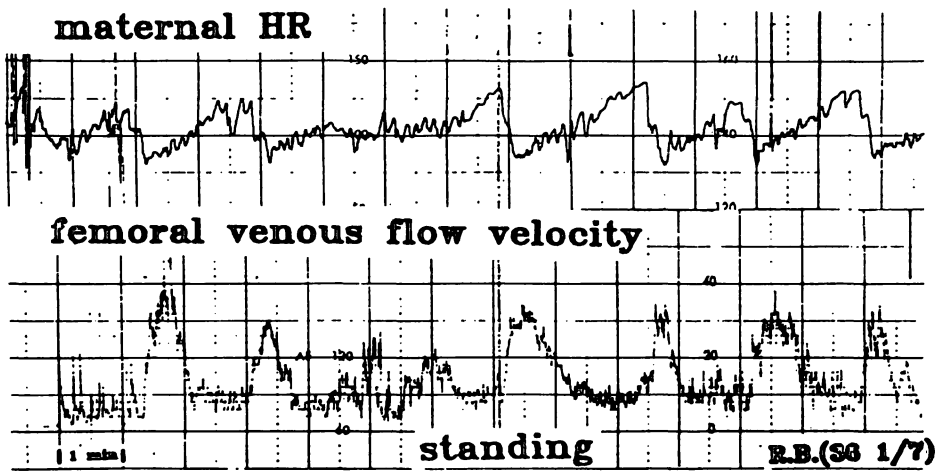

Fig.2: Simultaneous recordings of beat to beat heart rate and flow velocity in the vena femoralis of a woman in late pregnancy (36 1/7 wks).

In our series no patient fainted and in each cycle the heart rate returned to normal level spontaneously. This suggests that there exists an effective autoregulation system. According to our latest observations it seems that uterine contractions (Fig.3), although not noticed by the pregnant woman, appear and might be involved in the mechanism of restoring venous return.

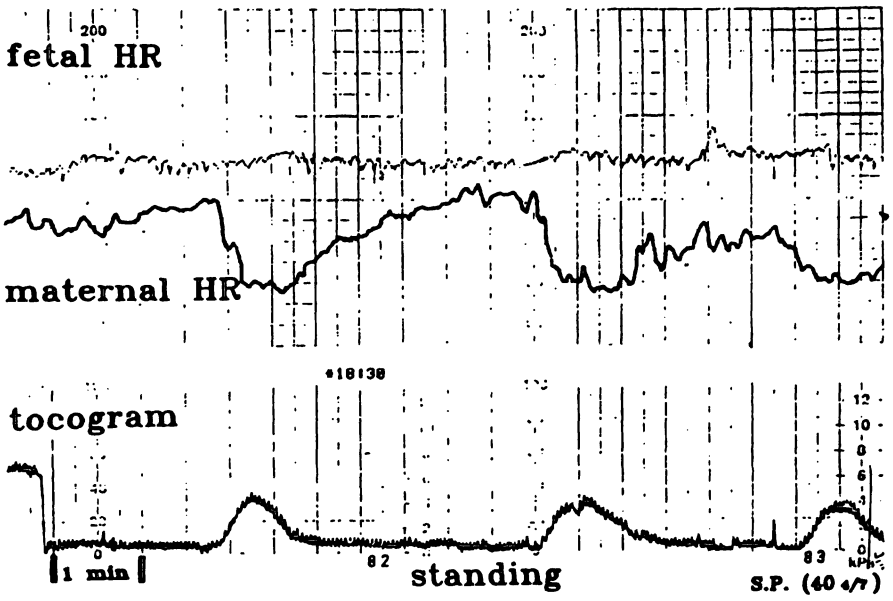

Fig. 3: Simultaneous recording of fetal and maternal beat to beat heart rate and external tocogram (40 4/7 wks).

It is surprising that this effect on the regulation of the circulation has not been recognised clinically, apart from an incidental reference (Hansen, 1942). This may be because there are no subjective symptoms and in the earlier studies the heart rate was averaged out.

Further studies of the oscillating response of maternal heart rate to standing are being made both with regard to the physiological mechanisms responsible for it, and concerning a possible connection with the reported worse fetal outcome in women working in standing posture (1-3).

References:

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